STRATIFIED SAMPLE DESIGN TO ESTIMATE HAWAII SEAT BELT USE RATES

Stratified Sample Estimation of Hawaii Seat Belt Use Rates. A model borrowed from Cochran (1977) and Kish (1965) was used to design stratified sample estimates. The primary stratum used was by island (county). The reason for this is that enforcement and other policies regarding restraint use are implemented at the county level. Additionally, due to cost limitations, the survey was limited to only the four most populated islands. The sampling unit in this study was defined in terms of the total number of registered vehicles in each county. Table 8.1 provides the total units, the number selected, and the respective probabilities of selection:

TABLE 8.1
MEASUREMENT OF SIZE AND SELECTION PROBABILITIES, JUNE 1-5, 2002

County	Registered Autos	Sample Size (n_h)	Probability of Selection
Oahu	614,985	29,902	.049
Maui	132,636	9,023	.068
Hawaii	132,305	5,909	.045
Kauai	61,316	5,711	.093

Because the measured variable in each application is a rate or proportion, the strata samples must be re-weighted to produce unbiased estimates of population proportion and variance.

The unbiased estimator of the population proportion, p, is

$$p = \sum_{h=1}^{H} W_h\, p_h,$$

where the county stratum weight is

$$W_h = \frac{county\ registration}{State\ registration}$$

and where n_h is the stratum size and p_h is the proportion of belt users in the stratum,

$$Var\,(p) = \frac{1-f}{n} \sum_{h=1}^{H} W_h\, \frac{n_h}{n_h - 1}\, p_h\,(1-p_h)$$

The sampling fraction f, is approximately 50,545/924,944 ? .06, and

$$n = \overset{H}{\underset{h-1}{?}}\, n_h$$

Sampling Weights. Weights for the counties and the weighted state proportion of seatbelt users are given in Table 8.2. A complete table is provided in Appendix 7 of this report.

TABLE 8.2
STRATUM WEIGHTS AND STATE ESTIMATES COMPUTATIONAL FORMAT, JUNE 1-5, 2002

County	Stratum Weight	Stratum p	Contribution to State p [wt*p(usage)]	Sample size (n_h)	Stratum Variance Component [(p)(1-p)]/ $n_h/(n_{h-1})$	Contribution to State Variance
Honolulu	0.633696	0.9108	0.5772	29,902	0.0812	0.0515
Maui	0.138710	0.8769	0.1216	9,023	0.1080	0.0150
Hawaii	0.151894	0.8907	0.1353	5,909	0.0974	0.0148
Kauai	0.075701	0.9273	0.0702	5,711	0.0674	0.0051
State Total			0.9043	50,545		
Overall Sampling Fraction =	0.005929				State Variance	0.0000016983
?/n =	1.96671E-05				Standard Deviation	0.001303202
Total Sample (N) = Confidence Interval =	50,545 **?0.26%**				Confidence Interval	0.002554276

The overall weighted state proportion is 0.9043. Each county contributes stratum variance between 0.0674 and 0.1080 and the variance of the proportion estimated from the total state sample is less than 1.70×10^{-6}. This methodology was reviewed by the Chief of Sampling Designs, National Center for Statistical Analysis, U.S. Department of Transportation.